Ultrasound

Now a standard imaging technique for prenatal imaging, ultrasound (US) uses ultrahigh frequency sound waves (over 20 kHz, but more often well into the MHz range) to bounce signals off anatomical features.

Strengths

Fetal imaging and echocardiography (imaging the heart) are well-established US techniques. Examination of the liver, bladder, kidney, aortic features, and even the eye, can also be accomplished with US. Advances in software and processing times have made possible three-dimensional reconstruction of US images,and research is being conducted in the assessment of fetal craniofacial abnormalities,diagnosis and presurgical staging of prostate cancer, differential diagnosis of mammogram-detected breast abnormalities, and guidance for tissue sampling. Doppler-flow US, incorporating velocity measurements of liquid flow, has proven efficacious for detection of deep-vein thrombosis (clotting) and peripheral vascular disease. US is gaining acceptance as an image guidance technique for both prostate and breast biopsy.

Limitations

Some US imaging must be conducted though a “water window,” often requiring patients to retain a full bladder for long periods. This requirement can be quite uncomfortable, especially for pregnant women and for men with prostate disease. Some US breast imaging methods once required viewing the breast on a water-filled bag, entailing in some cases awkward anatomical placements. Innovations in this area have eliminated some of these drawbacks. Like MRI, US is currently seen as inadequate for prostate cancer screening. US is therefore used along with other diagnostic methods such as prostate-specific antigen (for prostate cancer), human chorionic gonadotrophic hormone levels (for determination of gestational age in pregnancy), and other imaging modalities. Improvements in signal extraction and amplification, as well as integration with volume-filling computer models, can help expand US’s clinical role.